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# PATENT APPLICATION

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(54) **Pressure Transmitter.**

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This invention generally relates to devices called pressure transmitters that allow the remote transmission of an electrical image signal of a pressure to be measured.

Such pressure transmitters generally contain a device that is sensitive to pressure, at least one point of which is mobile in response to pressure, and an electrical conversion device that delivers an electrical image signal corresponding to the movements of such pressure sensitive device.

It has already been suggested that pressure transmitters of this type use a Bourdon tube as the pressure sensitive device.

The use of differential inductors as the electrical conversion device in such pressure transmitters has also been suggested; in other words, electrical conversion devices composed of two coils mounted in a symmetrical manner so that any increase, in the effect of this coil on delivered electrical signal causes a decrease in the effect of the other coil resulting from same electrical signal.

The object of this invention, as a new industrial product, is an electrical pressure transmitter of a particularly simple, reliable and efficient form, composed of the combination of a Bourdon tube with a differential induction conversion device, whereby this electrical conversion device allows the use of attributes of the Bourdon tube, whose strength qualities are well-known.

According to the invention, the pressure transmitter consists of a pressure sensitive device, at least one point of which is moves in response to pressure, and an electrical conversion device that is able to deliver an electrical image signal corresponding to the movements of the aforementioned mobile part of such pressure sensitive device. The transmitter is characterized by the fact that, jointly, the pressure sensitive device is a Bourdon tube and the electrical conversion device consists of a vane in magnetic material that is harnessed by a coupling rod on the end of the Bourdon tube and that is thus mounted with movable elements with three branches that are opposite the magnetic circuit. Each of the lateral branches bears a coil.

These coils are mounted in series, and their terminals can be linked to the terminals of any receiver, such as an indicator, a recorder, or a control device, of the radiometer type, for instance.

The movements of the magnetic vane of the invention's pressure transmitter in response to the pressure fluctuations to be measured, opposite of the magnetic circuit with three branches associated hereto, provoke a variation of the effect of the induction coils composed of the two windings of this magnetic circuit, an impedance variation resulting in a differential variation of the currents in the circuits in which these windings are inserted. These currents circulate in there and can be seen or recorded by the receiver branched at the terminals of the pressure transmitter.

According to one embodiment, the Bourdon tube extends along a circular arch, and the associated magnetic circuit is positioned on the inside of this circular arch, which leads to a particularly weak composition of the whole and allows an easy and rational facilitation of the Bourdon tube by adjusting the tube by the associated magnetic circuit.

According to another embodiment, the Bourdon tube extends along a helix, which allows it to increase its sensitivity, while conserving a diameter of reduced winding, and thus a minimal encumbrance.

In all cases, the entirety proves to be particularly robust, reliable and efficient.

The characteristics and advantages of the invention can be gathered from the description below, as an example, with reference to the attached schematic drawings, on which:

Figure 1 is a schematic diagram of the pressure transmitter according to the invention, and of the associated accessories;

Figure 2 is an axial view of an electrical pressure transmitter according to the invention, according to line II-II of figure 3;

Figure 3 is a plane view of this pressure transmitter, according to arrow III of figure 2, the hood of the housing in which it is positioned supposedly being removed;

Figure 4 shows an axial view of a variation of the pressure transmitter according to the invention.

In figure 1, the entire pressure transmitter, according to the invention, is labeled 10.



It consists of a pressure sensitive device, a Bourdon tube 11, whose open fixed end 12 receives the pressure P to be measured, and whose closed free end 13 is harnessed by a coupling rod 14 on a vane made of magnetic material 15.

This vane, made of magnetic material 15, is equipped with movable elements that are opposite the ends of a magnetic circuit with three branches 16, whereby the entirety constitutes the electrical conversion device associated with the pressure sensitive device, represented by the Bourdon tube 11.

Each one of lateral branches 17 of the magnetic circuit 16 bears a winding 18.

These windings 18 are mounted in series, and their central point 19 can be connected to one of the terminals 20 of a source of alternative tension 21.

The lateral terminals 22 of the windings 18 can be jointly connected to the terminals 23 of any type of receiver 24, for instance a radiometer type of indicator, as depicted, whereby such an indicator, for instance, can be in a mobile framework, a mobile magnet or in a mobile iron.

The windings 25 of this receiver are linked to the terminals 23 of such receiver by rectifier diodes 26, and their central point 27 can be connected to the second terminal 28 of the alternative tension source 21.

In the embodiment depicted, the windings 24 control a needle 30, which is mounted with moveable elements opposite a fixed scale 31.

In the rest position, as depicted, the magnetic vane 15 extends significantly and symmetrically on both sides of the central branch of the magnetic circuit 16.

The two windings 18 of this magnetic circuit, arranged identically, constitute two induction coils and even have impedance for this average rest position.

Subsequently, and based on the symmetry of the entire assembly, equal currents are applied to these windings 18 and, after

rectification by the diodes 26, equal currents are also applied to the windings 25 of receiver 24, whereby these windings are otherwise assumed to be identical to each other.



As a result, for this average rest position, the needle 30 of receiver 24 stands in the middle of the corresponding scale 31.

If, on the contrary, pressure P starts to vary in one direction or the other, the Bourdon tube 11 mechanically leads to magnetic vane 15 in a corresponding direction, in such a manner that the impedance of these windings 18 of the associated magnetic circuit vary in inverse directions; one impedance increases, whereas the other decreases.

The circulating current in the windings 25 of associated receiver 24 are no longer equal, and the needle 30 of this receiver changes position in one direction or the other with respect to its average rest position, which allows, averaging a suitable calibration, the measurement of pressure P.

The movement of the needle 30 of receiver 24 is in response to the currents running through the windings 25 of receiver 24; variations in tension will not influence the measurements.

In addition, the symmetry of the entire assembly eliminates the effect on the resulting measurements of the possible temperature variations to which the electrical components may be subjected. For a median indication of the receiver, these temperature variations will have no influence until the second order of extremities of the receiver's scale; in other words, it is easy to compensate the temperature of the entirety adequately using conventional means that will not be detailed herein.

In addition, it is possible to eliminate the effect on the resulting measurements of the form of the wave current delivered by source 21, subjecting two windings 25 of receiver 24 to the alternation.

In the embodiment illustrated in figures 1 and 2, the Bourdon tube 11 extends along a circular arch; through its open end 12, the Bourdon tube 11 is mounted on a base 35 which forms a housing 37 by means of a hood 36 that contains all the components of the pressure

transmitter according to the invention, and which is also equipped by a linking addition 38 at the exterior of this housing 37 that forms a pressure socket linked with the Bourdon tube 11.

Jointly, the magnetic circuit 16 is mounted on a plate 40 on the interior of the circular arch, formed by the Bourdon tube 11,



and this plate 40 is fixed onto the base 35 by screws 41 with sufficient play to allow the position of this plate 40 to be adjusted in relation to the base 35 that supports it.

The free ends of the branches of the magnetic circuit 16 form a circular arch jointly, and this is the same for the corresponding vane made of magnetic material 15.

The coupling rods 14 that harness this vane in magnetic material 15 at the free end 13 of the Bourdon tube 11 consist, in this embodiment, of a support in the form of circular sector 45 that mount said vane in magnetic material 15 peripherically and which [in turn] is mounted pivoting on an solid axle 46 of the base 35.

The coupling rods 14 consist furthermore of a joint 48 that harnesses said support in the form of circular sector 45 at the free end 13 of the Bourdon tube 11.

Preferably, and as depicted here, the length of this joint can be adjusted.

This can, for instance, involve two threaded shanks at inverse threads, united by a commonly threaded sleeve, as depicted here.

This joint, whose length can be adjusted, allows a zero regulation of the device in an advantageous manner.

The magnetic circuit 16 can advantageously consist of a stack of laminated sheet metal or an appropriate alloy.

The windings 18 which it supports are connected to terminals that are not represented in figures 2 and 3, by any means of appropriate electrical connection.

The hood 37 is fixed on base 35 in a suitable and conventional manner, for instance by mechanical pressure, welding or crimping.

Preferably, this hood 37 receives the necessary terminals by the connecting the entirety to an ordinary receiver, as well as to an alternative tension source.

In theory, air can circulate in housing 37, preferably by means of an intermediary filtering device that is not represented.

If a differential pressure transmitter is desired, housing 37 is waterproof and, furthermore, the addition 38 that forms a first pressure socket allows the Bourdon tube 11 [in such addition 38] to be connected to a first pressure source, and it



is equipped with a second pressure socket addition that is distinct from the previous one, so that its internal volume can be connected to a second pressure source (not represented).

As such, the Bourdon tube 11 reacts to the difference in pressures conducted on these internal and external walls.

In the preceding example, we assumed that the pressure transmitter according to the invention, and the associated receiver 24 are fed by an alternative tension source 21.

In the case of the feeding of a continuous current, the interior of the housing for the pressure transmitter is advantageously equipped with conversion devices to generate an alternating current based on such a continuous current feed(not represented).

In all cases, these metallic components can be advantageously composed of magnetic materials, reinforced with regard to their electrical elements.

In all cases, a condenser can also be advantageously placed between the final terminals to allow adjustments of the impedance to the corresponding receiver and also to purify the wave form of the alternating currents that run through the windings.

In the embodiment illustrated in figure 4, the Bourdon tube 11 extends to helixes between the base 35 that supports it and the plate 40 that carries the magnetic circuit 16; this plate 40 is fixed on the base 35, at a distance from it, by an intermediary, ordinary, solid spacer structure 50 on the base 35.

As has been previously stated, base 35 can be mounted in a regulating position on this spacer structure 50.

Furthermore, this spacer structure 50 carries the axle 46 that is used as the hinge of the support in the form of sector 45 that carries the vane in magnetic material 15.

As has been previously stated, a joint 48 harnesses the free end 13 of the Bourdon tube 11 on this support in the form of sector 45.

Figure 4 represents a socket in 60 that, carried by the hood 36 related to the connector 35, allows the electrical connection of the entirety to a receiver and to a power source.



Furthermore, in arrangement of the embodiment represented in figure 4, the addition 38, mounted on the base 35, can be disassembled 61 to allow the adjustment of the response time of the transmitter, by slowing down the fluid admitted into the Bourdon tube 11, and to allow the avoidance of the possible effects of the pressure wave.

It is well understood that the invention is not limited to the embodiments described and represented, but includes any variant of the execution and/or combination of their various elements.

CLAIMS

1. Pressure transmitter consisting of, on the one hand, a pressure sensitive device, at least one point of which moves in response to pressure, and on the other hand, an electrical conversion device that is able to deliver an electrical image signal corresponding to the movements of the mobile part of such pressure sensitive device, such a pressure transmitter being characterized by the fact that, jointly, the pressure sensitive device is a Bourdon tube and the electrical conversion device consists of a vane in magnetic material that is harnessed by coupling rods at the free end of the Bourdon tube and that is mounted in this way with moveable elements with three branches that are opposite a magnetic circuit, each lateral branch of which bears a winding.

2. Pressure transmitter according to claim 1, characterized by the fact that the coupling rods harnessing the mobile vane on the Bourdon tube consist of a joint whose length can be adjusted.

3. Pressure transmitter according to one of the ordinary claims 1, 2, characterized by the fact that the coupling rods, harnessing the vane in magnetic material on the Bourdon tube, consist of a support in the form of a circular sector that supports such vane peripherally, and which is mounted with pivoting functions, whereby the ends of the branches of the magnetic circuit form conjointly a circular arch, as well as the vane in magnetic material, and said coupling rods are furthermore composed of a joint harnessing said support at the free end of the Bourdon tube.

4. Pressure transmitter according to one of the ordinary claims 1 to 3, characterized by the fact the Bourdon tube is carried by a base equipped with a linking addition in connection with said Bourdon tube and characterized by the fact the magnetic circuit is supported by a plate that is fixed on said base, whose position can preferably be controlled.

5. Pressure transmitter according to one of the ordinary claims 1 to 4, characterized by the fact that the Bourdon tube extends along the

circular arch and the corresponding magnetic circuit is positioned on the interior of this circular arch.



6. Pressure transmitter according to one of the ordinary claims 1 to 4, characterized by the fact that the Bourdon tube extends along a helix.

7. Pressure transmitter according to one of the ordinary claims 1 to 6, characterized by the fact that it is housed in a housing, the internal volume is capable of air circulation, preferably through an intermediary filtering device.

8. Pressure transmitter according to one of the ordinary claims 1 to 6, characterized by the fact it is housed in a waterproof housing bearing two additions forming distinctive pressure sockets, one for the connection of the Bourdon tube to a first pressure source, the other for the connection of the internal volume of said housing to a second pressure source.

9. Pressure transmitter according to one of the ordinary claims 1 to 8, characterized by the fact that certain elements are made of magnetic material and constitute a shielding.

10. Pressure transmitter according one of the ordinary claims 1 to 9, characterized by the fact that these windings are placed in series, whereby a condenser is possibly placed between the terminals of said windings.

11. Pressure transmitter according to one of the ordinary claims 1 to 10, characterized by the fact that, for a continuous current feed, it is composed of conversion devices to generate the alternating current based on such feed.

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FIG. 1

FIG. 2

FIG. 3

FIG. 4